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HARDWARE IMPLEMENTATION OF SMART SOLAR TREE

[1]Bestha Madhusudhan,[2]Nagiri Ramalingeswara Reddy,[3]Akula Narasimha,[4]Damaka Divya,[5]Chakali Ganesh,[6]Mr. E. Ravi Teja
Department of EEE
St. Johns college of Engineering and Technology, Yemmiganur, AP

ABSTRACT
This project focuses on the creation of solar energy, primarily centered around the concept of a solar tree. This project demonstrates the high efficiency and significance of the solar tree for the current generation. This demonstrates the process by which solar trees transform solar energy into electrical energy. The sun emits a substantial amount of solar energy each day, which is more than sufficient to sustain humanity for many years. However, due to inadequate harnessing of this energy, there is a lack of sufficient energy production worldwide. Currently, solar panels are the most efficient means of producing electrical energy from solar power. However, it is important to note that solar panels demand a significant amount of area for installation. Therefore, this idea addresses the issue by using a solar tree, which involves the installation of solar panels on an artificial tree structure.

I. INTRODUCTION

It is a form of renewable energy resource that is competitive with fossil fuels in several ways. The force of energy of flowing water is known as hydropower. It generates almost all of the renewable energy in the United States. Hydroelectric power plants do not pollute the environment or use other energy to generate electricity. To avoid this problem, we can install a solar tree in spite of a no of solar panels which require a very small space.

The sun is a hydrodynamic spherical body of extremely hot ionized gases (plasma) that generates energy through the thermonuclear fusion process. The temperature of the sun’s interior is estimated to be between 8106 k and 40106 k, where energy is released by the fusion of hydrogen and helium.

Solar energy is abundant and widely regarded as the simplest and cleanest method of harnessing renewable energy. The following routes are available for direct conversion of solar radiation into usable form: solar thermal, solar photovoltaic, and solar architecture. The main issue with harnessing solar energy is the need to install large solar collectors, which take up a lot of space. To avoid this situation, we can install a solar tree, despite the fact that solar panels require a very small amount of space.

II. BLOCK DIAGRAM:

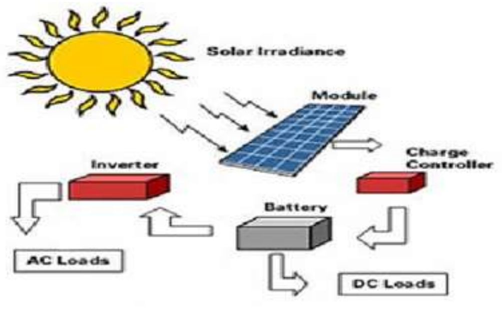

Figure 1: Structure of Solar System

Solar Energy:

Solar energy is radiant light and heat from the Sun that is harnessed using a range of technologies such as solar power to generate electricity, solar thermal energy including solar water heating, and solar architecture. It is an essential source of renewable energy, and its technologies are broadly characterized as either passive solar or active solar depending on how they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power, and solar water heating to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light-dispersing properties, and designing spaces that naturally circulate air. The large magnitude of solar energy available makes it a highly appealing source of electricity. Solar energy has been cheaper than fossil fuel.

Solar panel:

Solar energy begins with the sun. Solar panels (also known as "PV panels") are used to convert light from the sun, which is composed of particles of energy called "photons", into electricity that can be used to power electrical loads.

Solar panels can be used for a wide variety of applications including remote power systems for cabins, telecommunications equipment, remote sensing, and of course for the production of electricity by residential and commercial solar electric systems.

Charge controller:

A charge controller, charge regulator or battery regulator limits the rate at which electric current is added to or drawn from electric batteries to protect against electrical overload, overcharging, and may protect against overvoltage.

Battery:

A solar battery is a device that you can add to your solar power system to store the excess electricity generated by your solar panels. You can then use that stored energy to power your home at times when your solar panels don't generate enough electricity, including nights, cloudy days, and during power outages.

Inverter:

A solar inverter, is a type of electrical converter which converts the variable direct current (DC) output of a photovoltaic (PV) solar panel in to utility frequency alternating current (AC) that can be fed into a commercial electrical grid or used by a local, off- grid electrical network.

DC Loads:

The direct load can be directly powered up through solar power and a charge controller during the sunshine/day time and during the shading/night, the DC load can be powered up using the battery stored energy as backup power.

WORKING:

Photovoltaic cell converts sunlight in to electric energy and this effect is known as photovoltaic effect. Solar cells essentially create electricity by converting photons of light in to electrons. Solar cell producing direct current DC and the charge controller regulating the voltage and current flow from solar panels to battery and the battery stores the energy and this energy is given to the DC loads.

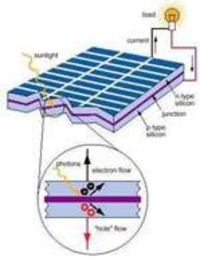

Figure 2: Structure of Solar Cell

A solar cell is a sandwich of n-type silicon (blue) and p-type silicon (red). It generates electricity by using sunlight to make electrons hop across the junction between the different flavors of silicon:

1. When sunlight shines on the cell, photons (light particles) bombard the upper surface.
2. The photons (yellow blobs) carry their energy down through the cell.
3. The photons give up their energy to electrons (green blobs) in the lower, p-type layer.
4. The electrons use this energy to jump across the barrier into the upper, n-type layer and escape out into the circuit.
5. Flowing around the circuit, the electrons make the lamp light up.

III. EXPERIMENTAL RESULTS:

Figure 3: Solar Tree

Figure 4: Solar Cell Application

The above figure shows the hardware prototype with components connected and results shown. This hardware helps us to give required amount DC power within the less space.

POWER GENERATION:

Total solar panels=13

One solar panel power rating= 40w Total power generation= 520w

LOAD UTILIZATION:

S.NO	TYPE OF EQUIPMENT	QUANTITY	RATING	LOAD	WORKING HOURS	ENERGY
1	Fans	4	80w	320w	4	1280wh
2	Lights	4	40w	160w	4	640wh
3	Laptop	1	40w	40w	1	40wh
Total				520w		1960wh

COST ESTIMATION:

S.NO	EQUIPMENT	QUANTITY	COST
1.	Solar panels	13	25000
2.	Designed tree	1	15000
3	Inverter(850VA)	1	5000
4.	Battery(150AH)	1	15000
Total			60000

IV. CONCLUSION:

Solar trees provide a solution to the limited availability of land, since they can be constructed and planted in any location worldwide. Given that sunlight is accessible in almost every corner of the Earth, there is no area where a solar tree cannot create electricity. The solar tree's most significant advantage is its minimal area need for installation. It eliminates the need for extensive acreage to accommodate solar panels while still generating an equivalent quantity of electrical power. The solar tree occupies just 1% of the land area needed by traditional techniques. The solar tree does not cause any interruption in the supply of electricity. It is feasible to create a sufficient amount of electrical power on a little land area to meet the global energy demand.

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